Zero Retries issue 0033 2022-02-18

Advanced Amateur Radio - Data Communications; Space; Microwave… the fun stuff! The Universal Purpose of Ham Radio is to have fun messing around with radios - Bob Witte K0NR. Ultimately, amateur radio must prove that it is useful for society - Dr. Karl Meinzer DJ4ZC. We are confronted by insurmountable opportunities! - Pogo. Nothing great has ever been accomplished without irrational exuberance - Tom Evslin. Irrational exuberance is pretty much the business model of Zero Retries Newsletter - Steve Stroh N8GNJ.

Steve Stroh N8GNJ, Editor

Jack Stroh, Late Night Assistant Editor

In this issue:

- **Request To Send**
- **US Amateur Radio Data Network (In the 2020s) - USARDN**
- **Feedback Loop**
- **ZR > BEACON**
- **Join the *Fun* on Amateur Radio**
- **Closing The Channel**

Request To Send

Countdown to Hamvention 2022 - May 20-22, in Xenia, Ohio - 13 weeks…

Automatic Packet Reporting System (APRS) is a (mostly) Amateur Radio protocol for transmitting status information (mostly location) via Amateur Packet Radio.

In **Wither APRS** in Zero Retries 0032, I said

> If you want to get involved with the future of APRS, APRSSIG is the center of the APRS universe. I've just rejoined that list to follow what comes next.

In the wake of Bob Bruninga WB4APR transitioning to Silent Keyboard status, the discussions on APRSSIG about the future of APRS are substantive and wide-ranging. There seems to be real planning underway, from those that have the ability to make things happen. I'm hopeful for the future of APRS and to see it start growing and evolving again, after a period of stagnation. It's neat to see some movement towards a "APRS Coalition" (my phrase, not a formal proposed name).

In the same issue I also said:

> Lastly, WB4APR offers a sobering reminder that none of us get out of this alive, despite our best efforts and hopes, *we don't know how much time we have*. So make the most of your life while you can. In a December 2020 YouTube video, WB4APR mentions briefly that two weeks after his retirement, he was diagnosed with cancer.

There's an old half-joke: "Want to hear God laugh? *Tell her your plans*."

Summer 2022 ~~promises~~ is trending as perhaps the best summer in a decade for me. In 2022, I'm not spending most of my waking hours on someone else's agenda for a paycheck, I'm not prepping a house for sale, packing nearly every possession into a moving box, preparing to relocate, in temporary residence, or moving in, etc. Early this year I begun mapping out an ambitious (for me) plan for Amateur Radio projects for Summer 2022 here at N8GNJ Labs, to fully commence after the big cross-country loop in May and the 2022 SEA-PAC Convention in Seaside, Oregon on June 3-5, 2022.

I've decided to internalize this summer's Amateur Radio activities as a memorial not just for WB4APR, but also for some dear friends that are also Silent Keyboards: Richard Ball N7RIG, Bob King K7OFT, Bob Donnell KD7NM, and Don Werts N7NKJ. All of them were active and always tinkering on various Amateur Radio projects, in their own ways, moving Amateur Radio forward. My goal is to get more data systems *on the air* on various data modes, using different radios. I'll make some notes here, but most of what I do at N8GNJ Labs will be on my N8GNJ.org blog.

The following was deferred from Zero Retries 0032 because… well, you know…
One nice thing about describing Zero Retries as a quirky little highly opinionated self-published newsletter that's free to subscribe to for a self-selecting niche audience … (with me so far?)… is that when things take interesting turns (Squirrel!), there are no points off for enjoying the diversion. My one tiny rule (to myself) is that when I do indulge in such diversions, the topic has to be (what I think) is "Zero Retries Interesting".

This week's "*Squirrel!*" came from Pseudostaffer Jeff Davis KE9V on Twitter on 2021-02-04:

> Rooting for a nation-wide network of VHF/UHF packet radio bulletin board systems doesn't necessarily make me a Luddite. <snip>

KE9V and I have had some email exchanges about what it would take to recreate a "mostly Amateur Radio" data network throughout the US. Apparently those discussions launched a background task in my mind and as soon as I saw KE9V's tweet, the idea for **US Amateur Radio Data Network** came tumbling out - see below.

There was a second "*Squirrel!*" that same week, but this week's issue doesn't allow space for it, so it will appear next week. Also, I haven't forgotten the LoRa / LoRaWAN followup - it's in queue.

This week's almost-an-afterthought experiment with a new feature in Substack - **Threads** *[tweet-length (1-3 sentences) that encourages general discussion.]* was a surprising success.

New post on N8GNJ.org resulted in far more feedback than I've ever had from an issue of Zero Retries. Per Substack: *After 24 hours, your public post has 322 views, 30 likes, 7 comments*. (I still haven't replied to all the comments.) ***Noted!*** Going forward I'll make more use of "Threads" for "out of band communications" for things that are more immediate or not quite a fit for inclusion in Zero Retries. After more than six months of publication, it's still early days for Zero Retries.

de Steve N8GNJ

US Amateur Radio Data Network (In the 2020s) - USARDN

Disclaimer - Yes, up front, the idea outlined here is, *at best*, a half-baked, probably harebrained, "rough sketch on a napkin" outline of kind-of an idea… that's probably impractical. But as I explained in Request To Send, sometimes such ideas are just fun to explore with 250+ friends and co-conspirators here in Zero Retries. If you buy into this ~~idea~~ concept, you *were* warned.

Inspiration for this idea is from a number of sources:

- Terrestrial Amateur Radio Packet Network (TARPN) is supporting the construction of regional networks of Amateur Radio Packet Radio links and nodes. While I admire their ideas in concept, I'm less rigid about their requirements. For example, I embrace the use of repeaters / digipeaters because sometimes that's the most efficient way to build a network and gain participants, especially for Amateur Radio newcomers.

- AREDN microwave networking is awesome, especially its ability to automatically form mesh networks providing 1 Mbps+ speeds, but 2.3 and 5.x GHz can be hard. VHF / UHF "higher" speed networks are synergistic with AREDN.

- Amateur Radio has an under-utilized long-range band - "6 meters" - 50-54 MHz. Compared to 144-148 MHz and 420-450 MHz, the lower "practically HF" frequency of 50-54 MHz makes it comparatively "easy" to build a customized data radio (see **Disclaimer** above). Not to mention antennas are easy to build (if, a bit unwieldy).

- We have "institutional" knowledge still out there of building wide area packet radio networks. Those worked great… considering the constraints of slow 1200 bps radios and hardware modems coupled with "NET/ROM" node software running in 32 kB ROM (software) and 32 kB RAM, zipping along at a 1 MHz clock speed in TAPR 2 type TNCs.

- In "them old days" of packet radio networking, TCP/IP was too resource-intensive and too bleeding-edge for most Amateur Radio Operators. Now it's ubiquitous to the point where there's a TCP/IP stack in light bulbs (yes, really - if it's communicating over Wi-Fi, it's got a TCP/IP stack).

- In place of the TNC-2 and other TNCs, we now have Raspberry Pi 4s with quad-core processors, 1 GHz+ clock speeds, as much as 8 GB RAM, and as much storage space as you can afford to connect to it.

- In “them old days” of packet radio networking, we had 1200 bps Audio Frequency Shift Keying as a modulation system that required a quiet channel for reasonable throughput, and 9600 bps Frequency Shift Keying which was even more demanding of a quiet channel. In this era, we have VARA FM and its ability to adapt to less-than-perfect channels along with longer range, higher throughput, and higher reliability.

- We can set up such a network / nodes to have fun with Bulletin Board Systems (BBS’), chat systems, file distribution, bulletins, etc. But we can also make it highly practical and useful in an emergency simply by adding a Winlink Radio Mail Server (RMS) at each node.

OK, the idea. *Again, see **Disclaimer** above. This **will** be rude, crude, and unattractive.*

- **Use 50-54 MHz for Longer Range Links** - My perception of the Amateur Radio 50-54 MHz band in the US is that it’s not utilized very heavily, especially compared to 144-148 MHz and 420-450 MHz. If those latter two are pretty quiet these days, I’d be shocked if 50-54 MHz isn’t even quieter than the other two. Thus the US Amateur Radio Data Network (USARDN) would use 50-54 MHz radios, perhaps transmitting at 100 watts for longer network links. “HF”, of which 50-54 MHz is at the top end of, seems to be a portion of spectrum where it’s possible to build dedicated Amateur Radio hardware (it’s much more difficult for spectrum above 54 MHz). I think we can still buy Amateur Radio equipment for 50-54 MHz - the Alinco DR-06TA, and it already has a “flat audio” interface!

    - Yes, I am aware that 50-54 MHz is used for simplex, contesting, meteor scatter, repeaters, Earth-Moon-Earth and other activities. I’m not proposing “usurping” those portions of 50-54 MHz - carry on with the fun there!

    - Yes, I am aware that there is often random ducting and other transitory paths that can play havoc with networking. Keep reading for addressing that issue.

- **Use VARA FM for Modulation** - VARA FM’s modulation is adaptive and fast. It can deal with noisy, inconsistent channels, it can do speeds up to 25 kbps, and it provides highly reliable service (within its constraints).

    - VARA FM has a number of issues that might discourage it for this use (it’s proprietary, runs only on Windows, requires payment of a license fee for full functionality). But…

    - Eventually there *will* be an open source equivalent of VARA FM that provides equivalent functionality. While VARA FM isn’t ideal, it’s good enough to get started, and when the open source equivalent arrives, it can be “bolted in” as a replacement for VARA FM.

    VARA FM is good enough to get started - let’s use it despite its issues.

- **Use Raspberry Pi computers for Routers / Nodes** - The Raspberry Pi has ample compute power, RAM, and storage for performing this task, and is inexpensive and, overall, a good fit for this function. It may even be feasible to crowdsource a customized

carrier board to use a Raspberry Pi 4 Compute Module to have all the needed functions integrated instead of the complexity of adding on additional boards. Such functions include temp monitoring (including external sensors), GPS input, battery monitoring, tiny UPS for orderly shutdown, watchdog timer, 12v power input conditioning circuitry, etc. I'd certainly rather buy such a board for a USARDN node than layering on several single-function boards.

- **TCP/IP is the "glue"** - Basing the communications in USARDN on TCP/IP allows flexibility to use whatever works in a given area and remain compatible. Communications can flow from a user connecting on 144-148 MHz into a USARDN node, via 50-54 MHz to another node 50 miles away, to another user connecting into that second node via high speed microwave AREDN. (Yes, this is Internet philosophy 101 - same protocol using myriad transports.)

- **Winlink built in** - At as many points as possible in USARDN, wherever there is the capability to implement Winlink connectivity via HF or Internet, that should be implemented. Winlink is the defacto EMCOM email solution, and it's been embedded into many EMCOM systems, and thus should be embraced.

- **APRS built in** - Similar to Winlink, at as many points as possible in USARDN, whereever there is the capability to implement an APRS digipeater / beacon / APRS-IS server on 144.390 MHz, that should be implemented

- **New Routing Protocols from old lessons learned** - One of my main takeaways from "them old days" of packet radio networks was that Net/ROM networking worked heroically well within the constraints of a dynamic routing table that had to fit into a portion of 32 KB RAM and a 1 MHz clock speed of a TNC-2 compatible TNC. But a primary limitation of that lack of memory / storage was that the routing table could not retain routes that were transient and those that were long term reliable. It was a Hobson's choice to either lock in static reliable routes but not not be able to make use of new routes when they appeared… or dynamic routes that weren't reliable long term resulting in routing chaos. That lack of memory / strorage was kind of fixed with systems that followed on to Net/ROM running on DOS and PCs, but those were never stable enough to deploy in large numbers and inaccessible sites like you could do with Net/ROM. But by then the bloom was off packet radio networking.

  Now memory / storage is not an issue - we can have the best of both worlds. When a new route appears, it can be on trial mode for a week or two before being considered stable, and if a route proves unstable, it can be ignored when it reappears (we tried that route and it didn't work out). With the higher speeds we can do more frequent network updates to adjacent nodes.

- **Supernodes?** - Perhaps we can create "supernodes" to span those long distances across the central parts of the country. If "supernodes" can be pitched as interesting enough, useful enough to the public (Winlink, EMCOM), perhaps they could be located on 1000+ foot television towers and mountaintops spanning many miles of terrain. There is grant funding available for "interesting projects".

What would we *do* with a US Amateur Radio Digital Network? I think the better question is

what *wouldn't* we do with such a network? The *possibilities are endless* once we're freed from the self-imposed constraints of low speed, unreliable data links or fast, but limited microwave networking… and not much in between. USARDN is that missing "… in between".

Feedback Loop

- **Josh Smith KD8HRX via email:** *In one of the various email threads on the aprssig mailing list regarding the future of APRS I became aware of your zero retries newsletter. I [immediately] subscribed and have been reading the archives. Every previous edition I've read so far has been superbly written and the topics are fascinating. Thank you,*

  Josh, Thanks for the kind words, especially "… topics are fascinating." The things I write about here in Zero Retries are *fascinating to me too!* (I'll leave the mundane stuff to the publications of the Amateur Radio Publishing Industrial Complex.) I try to write Zero Retries to reflect the same sense of wonder and admiration and sense of possibilities that I got from the many publications of my early Amateur Radio career, such as TAPR's Packet Status Register, Packet Radio Magazine, and especially the beloved 73 Magazine. I continue to posit that most Amateur Radio Operators have little idea of just how much technical advancement ***is going on in Amateur Radio***… if only "someone" was talking it up. Zero Retries is my attempt to "talk it up" but also "pay it forward" into Amateur Radio. As long as there are readers and subscribers, I'll try to keep writing Zero Retries to showcase all the interesting stuff in Amateur Radio.

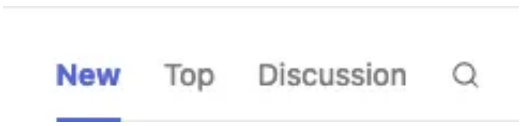
- **Chris Sullivan VE3NRT re: Zero Retries 0000:** *Good luck with the blog. I am going to try to catch up with your posts. I found your blog by searching around for ARDC and the recent grant to DARC for AX.25 Linux Kernel refurbishment. The prospect of more advanced RF modem technology interests me both practically and theoretically. Here in Canada we have more favourable regulations regarding data transmission in amateur radio, being exclusively defined by -26dB bandwidth. On 160 through 15, this is generally 6kHz (except 60 and 30), 20kHz on 10m, 30kHz on 6 & 2, 12MHz on 70cm, etc. This is an untapped area of opportunity that I'd like to keep learning about. I think I have about 3 years of catching up to do in the mathematics alone.*

  Chris recently discovered Zero Retries and has been enthusiastically (!) working his way forward in the archives from Zero Retries 0000 and commenting prolifically and thoughtfully. I'm enjoying his perspective as he works through each issue of Zero Retries. Chris' experience is exactly what I'd hoped for in using Substack as a publishing platform with its combination of email newsletters and web / blog posting for posterity. With that combination you can quickly "catch up" on previous topics and be up to speed on new topics.

ZR > BEACON

- Amateur Radio Digital Communications (ARDC) 2021 Annual Report is now available. It's a good overview of *some* of what ARDC accomplished in 2021. Recommended!

- **Zero Retries is now searchable!** Substack keeps incrementally improving its platform, and one recent (or perhaps I had just never noticed it) improvement is a small magnifying glass icon in the Archive section:

  Substack's new Archive Search Feature

  You'll see it to the right of **New | Top | Discussion -** 🔍. The Discussion "view" is also new / interesting - comments are now easier to follow there. In Closing The Channel at the end of each issue, **Search Zero Retries** is now a "just click here" button.)

- TAPR now offers versions of their **Weak Signal Propagation Reporter (WSPR) HAT** for Raspberry Pi computers for the 80 meter (3.5 - 4.0 MHz) and 160 meter (1.8-2.0 MHz) Amateur Radio bands. (At least they *did* - as you read this they're sold out.) These kits are great as starters for HF operations as they're standalone units (other than antenna and power) - no other radio required. It's amazing to see the power of advanced digital signal processing, both transmitting and receiving.

- Major Upgrade to the **hamvoip-asterisk Package**

  David McGough KB4FXC:

  > CHRISTMAS 2021
  > After about 1.5 years worth of development effort, I have just released a MAJOR upgrade to the hamvoip-asterisk package. This package includes the Asterisk/app_rpt software, which is the software that drives AllStar. This is the biggest upgrade in at least a decade, with about 15,000 lines of changed software!! For hot-spot, repeater and node radio users, the most visible change will be improved performance over the older software--meaning fewer crashes and fewer audio pops and clicks.

  See the link for details. I was not aware of HamVoIP. Per its website, it is "Asterisk Allstar on the Raspberry Pi 2/3/4, with a dozen servers scattered around the world. Note that this is not RasPBX which seems to be the primary Asterisk implementation for Raspberry Pi.

- **ESP-TNC** - Dana Myers K6JQ on APRSSIG - 2022-02-16

  > I did this science fair project a few years ago, started adding APRS-IS receive-only support and stuff. This is really pretty-much the result of an extended "hold my beer" exercise. The modem and packet handler work pretty well, though. Now I'm tempted to lash an audio codec to a ESP32-S3 and see if it works better.

  I love Science Fair / Hold My Beer projects!

Join the *Fun* on Amateur Radio

If you're not yet licensed as an Amateur Radio Operator, and would like to join the fun by *literally having a license to experiment with radio technology*, here are some pointers:

- **Ham Radio for Dummies** by Ward Silver N0AX is a great overview of Amateur Radio. N0AX is a gifted writer and HRFD is now in its 4th edition.
- My two favorite **YouTube** channels for a good overview of Amateur Radio are AmateurLogic.TV. and Ham Nation (part of Ham Radio Crash Course). These folks just seem to have so much fun!
- Radio Amateur Training Planning and Activities Committee (**RATPAC**) offers weekly presentations on general Amateur Radio topics (Wednesdays) and emergency communications in Amateur Radio (Thursdays).
- Dan Romanchik KB6NU offers a free **No-Nonsense Study Guide** for the Technician test (PDF).
- HamExam.org Amateur Radio Practice Exams offers good **Flash Card and Practice Exams**.
- When you're ready to take an **Amateur Radio examination** (Tech, General, or Extra), W1MX - The MIT Amateur Radio Society offers remote exams, free for students and youngsters. *There are apparently many other remote exam options*.

Bonus - with an Amateur Radio license, you'll be more attractive on dates 😀

Closing the Channel

- In its mission to grow Amateur Radio and make it more relevant to society in the 2020s and beyond, Zero Retries is published via email and web, and is available to anyone at no cost. Zero Retries is proud *not to participate* in the Amateur Radio Publishing Industrial Complex!
- My ongoing Thanks to Tina Stroh KD7WSF for, well, *everything*, Bill Vodall W7NWP as *Zero Retries Instigator in Chief*, and Larry Gadallah NM7A for his long term encouragement about Zero Retries.
- My ongoing Thanks to pseudostaffers Dan Romanchik KB6NU, Jeff Davis KE9V, and Steve Lampereur KB9MWR for continuing to spot, and write about "Zero Retries Interesting" type items, on their respective blogs, from Amateur Radio and beyond, that I don't spot on my own.
- Southgate Amateur Radio News consistently surfaces "Zero Retries Interesting" stories.
- The Substack email publishing platform makes Zero Retries possible. I recommend it for

publishing newsletters.

If you see something interesting mentioned in Zero Retries and would like to search all the Zero Retries "Back Issues", that's now easy - just click:

Search Zero Retries

If you're reading this issue on the web and you'd like to see Zero Retries in your email Inbox every Friday afternoon, just click:

Subscribe now

If you're a fellow smart person that uses **RSS**, there *is* an **RSS feed for Zero Retries**.

Zero Retries is on Twitter *@zero retries* - just click:

Zero Retries on Twitter

Please tell your friends and co-conspirators about Zero Retries - just click:

Share Zero Retries

Offering **feedback or comments** for Zero Retries is equally easy; yes, you guessed it… just click:

Leave a comment

Email issues of Zero Retries are "instrumented" by Substack to gather basic statistics about opens, clicking links, etc. I don't use such information in any way other than seeing that most subscribers actually do read Zero Retries.

All previous issues of Zero Retries are available without restriction (no paywalls). For some background, Zero Retries 0000 was the **Introduction Issue**. Zero Retries 0026 and Zero Retries 0027 were a **2021 Year End Review** of Zero Retries.

More bits from Steve Stroh N8GNJ:

- SuperPacket blog - *Discussing new generations of Amateur Radio Data Communications - beyond Packet Radio (a precursor to Zero Retries)*
- N8GNJ blog - *Amateur Radio Station N8GNJ and the mad science experiments at N8GNJ Labs - Bellingham, Washington, USA*

Thanks for reading!
Steve Stroh N8GNJ (He / Him)
These bits were handcrafted in beautiful Bellingham, Washington, USA

2022-02-18

If you'd like to reuse an article in this issue, for example for club or other newsletters, just ask.

Please provide credit for the content to me and any other authors.

All excerpts from other authors are intended to be fair use.

Portions Copyright © 2021-2022 by Steven K. Stroh.

Blanket permission granted for TAPR to use any Steve Stroh content for the TAPR Packet Status Register (PSR) newsletter (I *owe* them from *way* back).